IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Ivan V. MENDENHALL Robert D. TAYLOR	Group No.: 1755
Serial No.:	10/704,499	Examiner: Aileen Baker Felton
Filing Date:	07 November 2003	
Title:	BURN RATE ENHANCEMENT VIA METAL AMINOTETRAZOLE HYDROXIDES	
Customer No.:	45483	

DECLARATION OF DR. IVAN V. MENDENHALL

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Declarant, Dr. Ivan V. Mendenhall, declares as follows:

1. I am one of the joint inventors of the subject matter described and claimed in the above-identified patent application.

I hereby certify that this correspondence (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service as First Class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on

29 September 2008

29 September 2008 _____
Date Signature

2. I have a Doctorate degree in Food Chemistry and a Bachelor of Science degree in Chemistry, each from Utah State University.

3. I have more than sixteen years of work experience, including more than four years experience as an Analytical Chemist and more than twelve years experience as a Formulation Chemist, studying gas generating formulations in the field of energetic materials, including the study of copper compounds and chemistry and the use of copper compounds in gas generating formulations.

4. I am presently the Senior Specialist of Formulation Chemistry for Autoliv ASP, Inc., a corporation duly organized and existing under and by virtue of the laws of the State of Indiana and having a principal office and place of business at 3350 Airport Road, Ogden, Utah 84405.

5. I have read and reviewed the Office Action dated as mailed 31 March 2008 ("Office Action") and the outstanding prior art rejections of the pending claims appearing therein.

6. I have read and reviewed:

a. cited and applied U.S. Patent 5,742,647 to Blau et al., including its specification and claims; and

b. cited and applied U.S. Patent 6,143,102 to Mendenhall et al., including its specification and claims.

7. I am one of the joint inventors of the subject matter described and claimed in U.S. Patent 6,143,102 to Mendenhall et al. and am closely familiar with the disclosure therein contained.

8. In the Office Action, Claims 39-51 were rejected as being unpatentable over U.S. Patent 5,742,647 to Blau et al. The Office Action asserts:

> Blau discloses slurry mixing of oxidizer such as copper hydroxide and fuel such as 5-aminotetrazole.

The Office Action further asserts:

> It would have been obvious to one having ordinary skill in the art at the time the invention was made to have the claimed compounds present in the composition since they will form upon reaction of two compounds that are combined in a slurry and then added to the composition.

9. Based on my experience in working with copper compounds and the use of copper compounds in gas generating formulations, the slurry mixing of oxidizer such as copper hydroxide and fuel such as 5-aminotetrazole, as set forth in the Office Action as disclosed in U.S. Patent 5,742,647 to Blau et al., does not result in the formation of metal aminotetrazole hydroxides, particularly copper aminotetrazole hydroxides, in accordance with the invention.

10. In further support thereof, I have conducted and/or closely supervised a series of tests and analysis to determine, evaluate and compare materials resulting from the slurry mixing of copper hydroxide and 5-aminotetrazole, in accordance with U.S. Patent 5,742,647 to Blau et al., with metal aminotetrazole hydroxides, particularly copper aminotetrazole hydroxides, in accordance with the invention.

a. U.S. Patent 5,742,647 to Blau et al., in its sole example in accordance with the invention thereof (Example 1), described a process wherein a non-azide fuel (bitetrazole amine monohydrate) and an oxidizer (cupric oxide) are combined to form an anhydrous tetrazole gas generant composition that is shaped by compression and that retains its structural integrity after 24 hours of exposure to 45% RH at 25° C. In accordance with the method of this Example, the fuel and oxidizer are blended in a muller mixer with approximately 2.5% water for 1 hour to obtain a compactable powder. The compactable powder is then blended in a Hobart mixer with approximately 25% water for 15 minutes to obtain a paste. The paste is then allowed to air dry at about 40° C until the consistency is suitable for agglomeration such as by pushing through a 16 mesh screen. The partially dried granules are then dried to a constant weight at a temperature of 31° C after which they are dried to completion at 120° C for 24 hours to remove the remaining water.

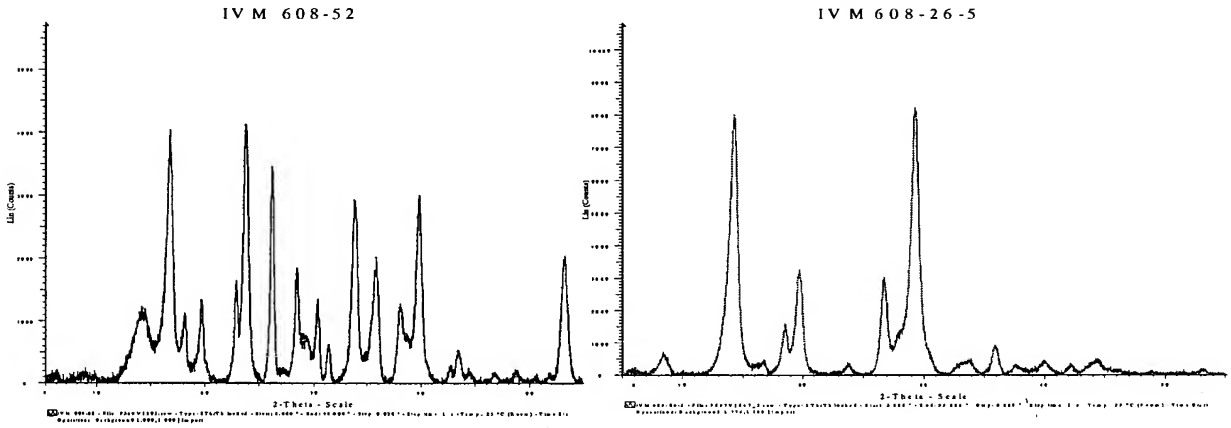
b. Laboratory scale samples of 5-aminotetrazole and cupric hydroxide, respectively, in stoichiometric amounts required to make copper aminotetrazole hydroxide were processed by the method of the Example of U.S. Patent 5,742,647 to Blau et al. This sample, the "Blau Sample", in the below presented data is referred to as sample "608-52".

c. As a comparison, equal quantities of 5-aminotetrazole and cupric hydroxide were processed by the methods described in the subject application to form copper 5-aminotetrazole hydroxide. This sample, the "Invention Sample", in the

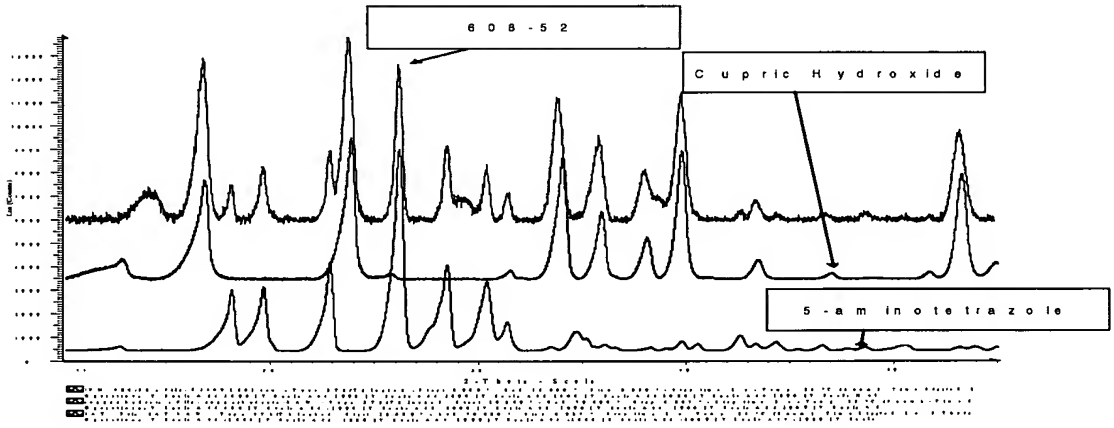
below presented data is referred to as sample "608-26-5".

11. Both the Blau Sample and the Invention Sample were analyzed via x-ray diffraction, thermogrametric analysis, and differential scanning calorimetry, respectively, and the percent copper, carbon, hydrogen, nitrogen, and oxygen in each Sample were measured/determined. The results are presented in the following figures and discussed below:

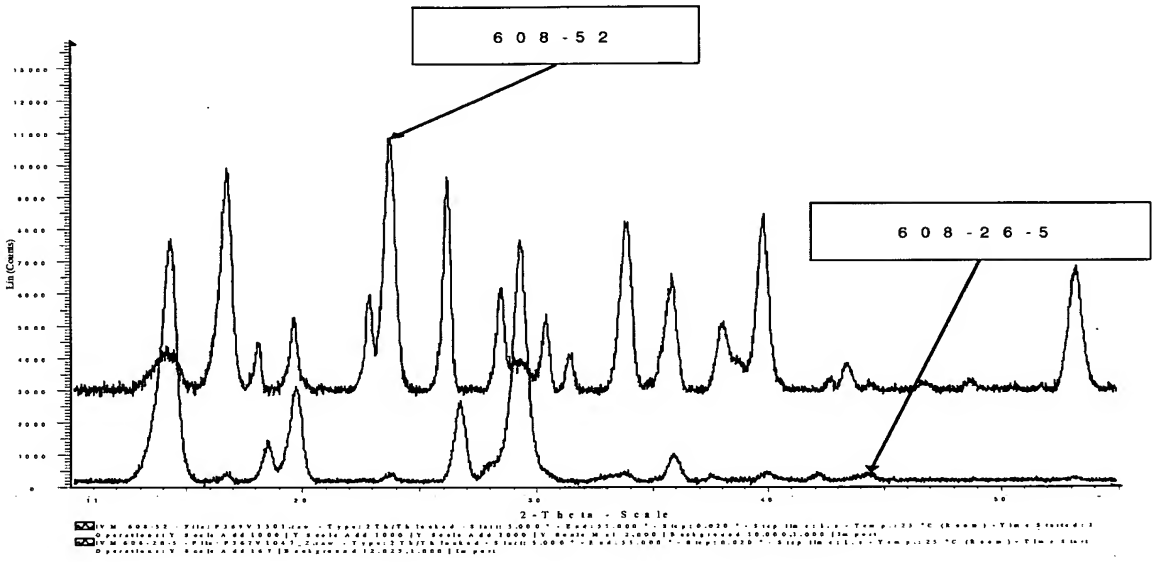
a. X-ray Diffraction Pattern of the Samples



To assist in the analysis, the X-ray diffraction pattern of Sample 608-52 was overlayed with the diffraction patterns of 5-aminotetrazole and cupric hydroxide, as shown below.



The X-ray diffraction pattern of Blau Sample (608-52) and the Invention Sample (608-26-5), respectively, are together shown below.



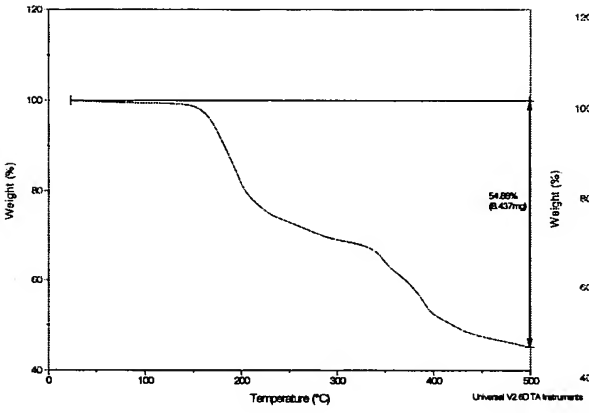
DISCUSSION:

The x-ray diffraction patterns clearly show the presence of different peaks in the Blau Sample (608-52) versus the Invention Sample (608-26-5). The peaks in the sample prepared by the Blau method are attributable to the continued presence of unreacted 5-aminotetrazole and cupric hydroxide, as visually observed.

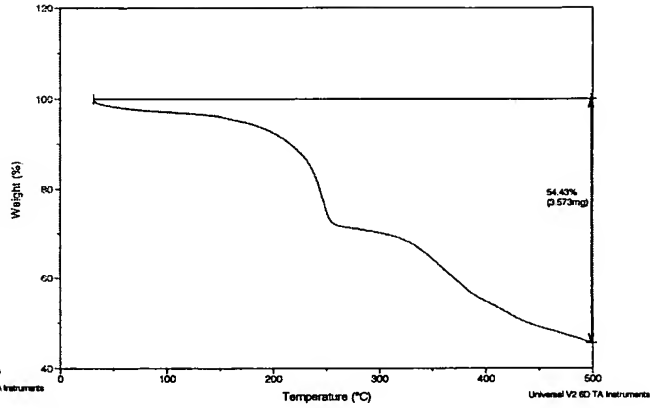
The peaks appearing in the x-ray diffraction pattern of the Invention Sample and not present in the Blau Sample are attributable to the presence of copper aminotatrazole hydroxide, not present in the Blau Sample.

b. Thermogravimetric Analysis of the Samples

608-52

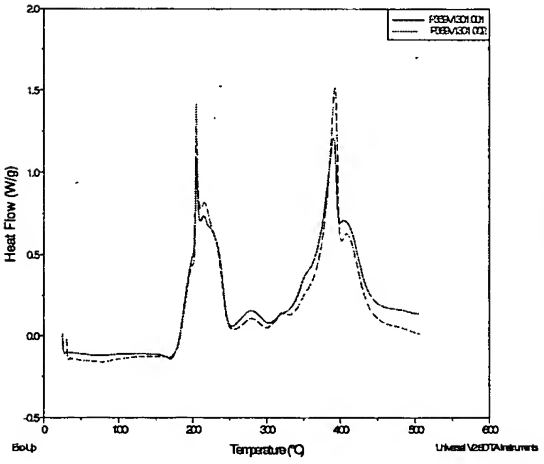


608-26-5

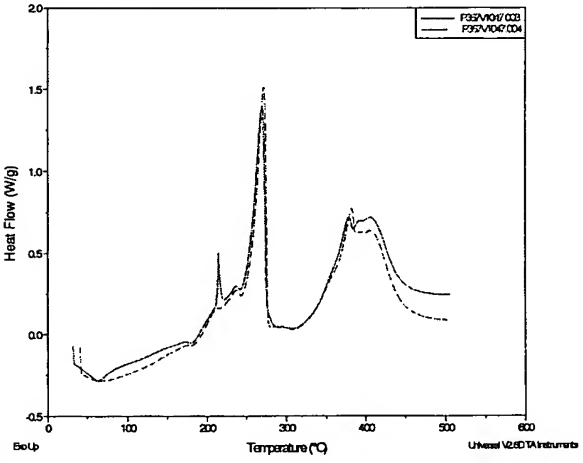


c. Differential Scanning Calorimetry of the Samples.

608-52



608-26-5



DISCUSSION:

The thermogravimetric analysis and the differential scanning calorimeter data were consistent in showing the difference in the samples. Sample 608-52 shows a weight loss onset and exotherm onset at approximately 150° C. This is consistent with the thermal properties of copper bis 5-aminotetrazole when the temperature is ramped at 10 °C/min. Sample 608-26-5 shows a weight loss onset and exotherm onset between 200 and 250 °C which is consistent with thermal properties of copper aminotetrazole hydroxide when the temperature is ramped at 10 °C/min.

d. Elemental Analysis of Samples

TABLE 1

	608-52	608-26-5
% Cu	35.76	35.13
% C	7.25	7.05
% H	2.03	1.86
% N	39.28	40.46
% O	11.70	10.54

The elemental analysis was not a great discriminator between the compounds. The theoretical elemental composition of an unreacted equimolar mixture of 5-amino tetrazole and cupric hydroxide and copper aminotetrazole hydroxide are shown in TABLE 2, below.

TABLE 2

	Equimolar mixture of 5-amino tetrazole and cupric hydroxide (608-52)	Copper aminotetrazole hydroxide (608-26-5)
% Cu	34.78	38.62
% C	6.58	7.29
% H	2.73	1.82
% N	38.37	42.54
% O	17.52	9.72

The data for both samples matched well within the limits of the test with the exception of the oxygen and hydrogen content of sample 608-52. This is due to the fact that there is some conversion of 5-aminotetrazole and cupric hydroxide to copper bis aminotetrazole with the liberation of water. This reaction occurs at the surface of the copper hydroxide particles. Further evidence of this reaction is the green color of sample 608-52. The color of copper bis aminotetrazole is green. The color of copper 5-aminotetrazole hydroxide is lavender.

CONCLUSION

12. Slurry mixing of oxidizer such as copper hydroxide and fuel such as 5-aminotetrazole as set forth in the Office Action as disclosed in U.S. Patent 5,742,647 to Blau et al., does not result in the formation of metal aminotetrazole hydroxides, particularly copper aminotetrazole hydroxides, in accordance with the subject patent application.

13. All statements made herein of my knowledge are true; all statements made on information and belief are believed to be true; and I make these statements with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Ivan V. Mendenhall

Dr. Ivan V. Mendenhall

September 23, 2008

Date

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